

RADIOTELEMETRY COLLARS AND MOUNTAIN SHEEP: A CAUTIONARY NOTE

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Abstract: We describe several types of injuries associated with loose-fitting telemetry collars in male and female mountain sheep (*Ovis canadensis* ssp.), and 1 injury incurred by a male from an overly tight telemetry collar. The potential proximate and ultimate effects of poorly fitting collars include serious injuries to osseous and dermal tissues, altered foraging behavior, and decreases in the fitness of otherwise dominant males. Researchers are encouraged to use extreme caution when marking mountain sheep, and other species, with telemetry collars, because of the potential ramifications for the animals and for future research.

Key words: collars, injuries, *Ovis canadensis*, radiotelemetry, techniques, telemetry.

The use of collars for marking large, wild mammals has a long history, beginning with the use of "bells" (Taylor 1947) and made more popular by Progulske (1957). Indeed, the advent of reliable telemetry packages and increased funding for research have resulted in large numbers of collars being placed on wildlife. Researchers have developed expandable collars or breakaway collars (Jordan 1958, Hamilton 1962, Kolz and Johnson 1980, Steigers and Flinders 1980, Keister et al. 1988, Hellgren et al. 1988), to allow for neck-swelling during the rut by male cervids, or expansion for growth if young animals are collared. Historically, the intent has been to minimize the effects of collars and/or telemetry packages on animals being studied, and recent guidelines (Committee on Acceptable Field Methods 1987) suggest that methods used to mark wild animals not abrade or restrict body parts.

Cochrane (1980) noted that researchers may be faced with difficult choices when collaring wild animals. For example, should one use a tight-fitting collar, placed near the head, or a loose-fitting collar, that may slide back and forth, placed lower on the neck? He emphasized

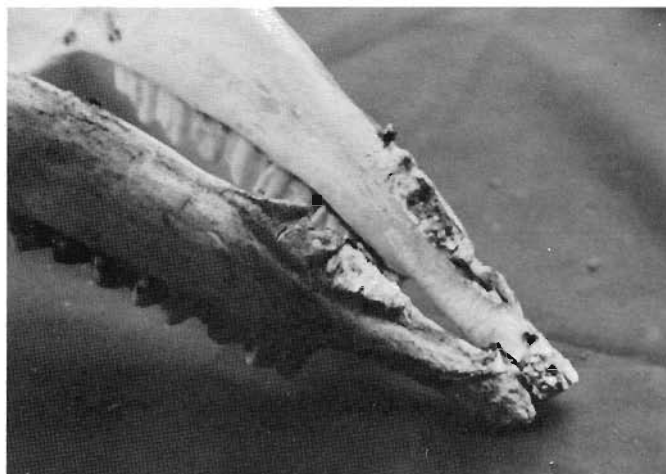


Fig. 1. Ventro-lateral view of the mandible of a 7-year-old mountain sheep ram, originally collared as a 5-year-old. The ram wore a loose-fitting radio collar from November 1984 through August 1986. Note the osteophytes along the ventral surfaces of the rami.

that trial and error, coupled with a knowledge of anatomy and behavior, are factors that, ultimately, result in optimal attachment methods. Practical and ethical considerations make it imperative that safe and humane methods are used in field investigations. We describe injuries to mountain sheep in California that were associated with poorly fitted collars.

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The first translocation of telemetered mountain sheep in California occurred in 1979. By 1983, opportunities to handle and mark animals increased markedly (Wehausen et al. 1987). Because of an aggressive translocation program (Bleich et al. 1990), approximately 30 sheep have been collared each year from 1983 through 1989.

Initially, telemetry collars were placed very loosely on the study animals, because of concern that snug collars might be life-threatening. Collars were so loose that they continually slid up and down the necks of the animals as they fed. In 1983, it was noticed that such loose-fitting collars resulted in substantial hair loss on necks. At that time, we raised the issue of (1) heat loss associated with decreased insulation on sheep wintering high in the Sierra Nevada, and (2) potential injuries to the lower jaws of clashing rams from loose collars. Subsequently, we detected dermal lesions on the dorsal neck surfaces of rams and ewes fitted with loose collars, and swelling under the lower jaws of some rams.

Table 1. Collar circumferences (cm) for female mountain sheep (*O. c. nelsoni* and *O. c. californiana*) collared from 1983 to 1988 in California.

Years	n	Collar circumference (cm)			
		\bar{x}	SD	Range	CV
1983	2	50.3	10.0	43.2-57.3	19.6
1984	8	48.1	3.0	44.5-53.5	6.2
1985	8	38.8	3.6	33.7-43.5	9.2
1988	9	35.8	1.6	33.0-38.1	4.3
1983-88	27	41.4	6.6	33.0-57.3	15.9

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Table 2. Differences (cm) between collar circumferences and neck circumferences for male and female mountain sheep (*O. c. nelsoni* and *O. c. californiana*) collared from 1984 to 1988 in California.

Year	n	Collar circumference-neck circumference (cm)			
		\bar{x}	SD	Range	CV
1984	10	14.3	3.5	8.4–20.0	24.3
1985	2	4.2	1.3	3.2–5.1	30.1
1988	10	3.1	1.4	1.3–5.1	45.2
1984–88	22	8.3	6.1	1.3–20.0	73.8

Several ram carcasses were recovered shortly thereafter, 3 of which exhibited significant injuries that we attributed to loose-fitting telemetry collars. The 3 rams discussed here ranged in age (at time of collaring) from 3 to 5. Two wore telemetry collars for 2 years, and one for 4 years, prior to their deaths. Mandibles from these animals exhibited substantial proliferation of bone along the ventral, lateral, and medial surfaces of the rami (Fig. 1). Numerous small osteophytes were present on the lateral and ventral surfaces, with the lesions up to 1 cm long. Such lesions are consistent with those that would be expected to result from chronic irritation of bone in the areas of their occurrence. We believe these injuries were caused by a loose-fitting transmitter hitting the lower jaw (where it is covered by only a thin layer of tissue) during episodes of feeding, running, and horn clashing. The extreme forces associated with the latter activity (Schaffer 1968, Schaffer and Reed 1972, Kitchener 1988) may explain the absence of similar lesions in female sheep.

Between 1983 and 1988, the incidence of such injuries decreased markedly. We observed no such lesions on animals collared after 1985; trial and error (Cochrane 1980) had caused us to place collars on more tightly. There is a significant decrease (Kruskall-Wallis One-Way Analysis of Variance, $\chi^2 = 19.0813$, 3 df, $P = 0.0003$) in circumferences of collars installed between 1983 and 1988, for which we have measurements (Table 1). Similarly, the difference between collar circumference and neck circumference decreased significantly (Kruskall-Wallis One-Way Analysis of Variance, $\chi^2 = 15.9403$, 2 df, $P = 0.0003$) between 1984 and 1988 (Table 2). We surmise that snug-fitting collars greatly reduce the risk of injuries associated with radio collars. Similarly, Fancy et al. (1988) noted a decrease in injuries to caribou (*Rangifer tarandus*) when collars were placed more tightly around necks.

In our experience, most sheep researchers tend to install collars loose-



Fig. 2. Ventral view of the neck of a 4-year-old mountain sheep ram that had worn an overly-tight radio collar from September 1987 through December 1989. Note the severe dermal lesions associated with the collar.

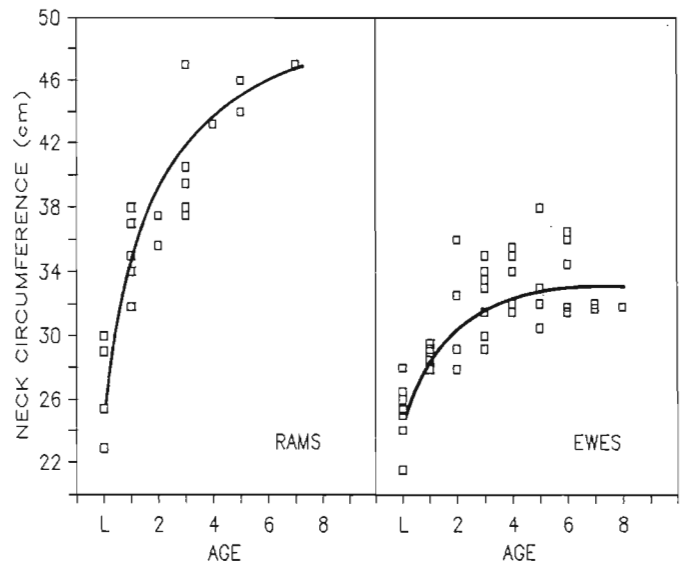


Fig. 3. Neck circumference, as a function of age, for 20 mountain sheep rams and 40 ewes for which neck measurements are available. Neck circumferences in females become asymptotic at an earlier age than in rams.

ly. We believe that injuries are more likely to occur when that is the case, and recommend that the collars be installed as high up on the neck as possible, and as tightly as possible, without constricting the neck. However, in 1989 we documented injuries associated with an overly tight collar. That collar had been placed on a 2-year-old ram in 1987, at a circumference appropriate for an adult ewe. As the ram grew, severe lesions developed on the neck under the collar (Fig. 2). These lesions were not visible, however, without removing the collar; they were discovered only when the animal was captured to replace its non-functional telemetry collar. This problem occurred because future growth was not considered when the original collar was installed.

Because of the extended growth period of rams compared to ewes, the 2 sexes attain maximum neck circumferences at different ages (Fig. 3). For 23 ewes >3 years of age, minimum neck circumference varied from 30.5 to 38 cm, with an average of 33.4 cm. For the same populations, the asymptotic neck circumference for rams was 47 cm. We now use these values as guidelines when collaring sheep that have significant body growth to complete.

Aside from the obvious potential for loose-fitting collars to cause injuries, other ramifications exist. Loose-fitting collars frequently strike sheep under the chin during feeding bouts (Berbach 1987). Such events may alter feeding behavior and nutrient intake, and may cause researchers to record nonrepresentative foraging data. Alteration of male dominance behavior also is likely. Further, an otherwise dominant male, debilitated by an improperly fitting telemetry collar, may not fully realize his evolutionary fitness because of painful jaw injuries incurred during horn clashes.

Finally, the ramifications of injuries associated with wildlife research must be considered in the context of their potential effects on future research projects. Animal rights proponents, and others associated with the humane movement, will be quick to seize upon any opportunity to discredit the wildlife management profession. The Committee on Acceptable Field Methods of the American Society of Mammalogists (1987) has addressed the question of properly-fitted telemetry packages; careful adherence to that policy is urged because of the potential for impacting future research opportunities should concerned individuals take issue with the problems created by ill-fitting collars.

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